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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/683,985	03/08/2002	Steven H. Voldman	BUR920020014	2597
24241 7590 04/11/2007 IBM MICROELECTRONICS INTELLECTUAL PROPERTY LAW 1000 RIVER STREET 972 E ESSEX JUNCTION, VT 05452			EXAMINER NADAV, ORI	
			ART UNIT	PAPER NUMBER
			2811	
SHORTENED STATUTORY PERIOD OF RESPONSE		MAIL DATE	DELIVERY MODE	
3 MONTHS		04/11/2007	PAPER	

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

09/683,985

Applicant(s)

VOLDMAN, STEVEN H.

Examiner

Ori Nadav

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 September 2006.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 26-42 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 26-42 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 33 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. There is no support for a cathode comprises forming a first doped region of a second conductivity type abutting said anode, and forming a second doped of said second conductivity type abutting and disposed below said first doped region and contacting said original substrate, said first and second doped regions having different dopant concentrations, as recited in claim 29, wherein the cathodes further comprises a third doped region between said first doped region and said second doped region, as recited in dependent claim 33.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 30 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant

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regards as the invention. The claimed limitations of forming a second pair of isolation structures between said adjacent isolation regions and said anode, as recited in claim 30, are unclear as to structural relationship between the adjacent isolation regions and the diode.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 26-27, 29-30 and 39-41, as best understood, are rejected under 35 U.S.C. 102(b) as being anticipated by Xu (6,437,383).

Regarding claims 26 and 29, Xu teaches in figures 7-10 and related text a method of forming a diode comprising the steps of:

providing an original substrate 120 not doped with anode and cathode regions and forming an anode 160 of a first conductivity type and a cathode 150 of a second conductivity type disposed below said anode on said original substrate without removing any portion of said original substrate and without replacing with another substrate material, wherein

at least one of said cathode and anode comprise a plurality of vertically abutting diffusion regions 140, 150, and

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forming a plurality of isolation regions 130 in said original substrate, said cathode and anode being disposed between adjacent ones of said plurality of isolation regions, said plurality of isolation regions extending deeper into said original substrate than said cathode and said anode, wherein

said step of forming said cathode comprises forming a first doped region 150 of a second conductivity type abutting said anode 160, and forming a second doped region 140 of said second conductivity type abutting and disposed below said first doped region and contacting said original substrate, said first and second doped regions having different dopant concentrations.

Regarding claim 27, Xu teaches in figures 7-10 and related text a plurality of insulation-filled trenches having sidewalls that are substantially vertical.

Regarding claim 30, Xu teaches in figures 7-10 and related text forming a second pair of isolation structures 132 between said adjacent isolation regions and said anode.

Regarding claims 39-41, Xu teaches in figures 7-10 and related text said cathode being in electrical contact with said substrate and is disposed entirely below said anode, wherein a junction formed between said anode and said cathode is bounded by said adjacent ones of said plurality of isolation regions.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 31-32 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu.

Regarding claims 31-32, Xu teaches in figures 7-10 and related text substantially the entire claimed structure, as applied to claim 26 above, except explicitly stating that isolation regions 130 are formed by a process comprising the steps of etching said substrate to form trenches and depositing at least one insulator, removing portions of said insulator outside of said trenches, and depositing a fill material.

Xu teaches in figures 7-10 and related text isolation regions 132 are formed by a process comprising the steps of etching said substrate to form trenches and depositing at least one insulator, removing portions of said insulator outside of said trenches, and depositing a fill material.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to form isolation regions 130 by a process comprising the steps of etching said substrate to form trenches and depositing at least one insulator, removing portions of said insulator outside of said trenches, and depositing a fill material in Xu's device, in order to simplify the processing steps of making the device by using conventional processing steps.

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Regarding claim 42, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a single crystal substrate in Xu's device in order to improve the characteristics of the device.

Claim 28, 33, 35, 37-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu in view of Chen et al. (6,242,763).

Regarding claim 28, Xu teaches substantially the entire claimed structure, as applied to claim 26 above, except isolation regions having tapered sidewalls.

Chen et al. teach in figure 3 and related text isolation regions 204 having tapered sidewalls.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use isolation regions having tapered sidewalls in Xu's device in order to improve the isolation of the device and in order to adjust the device characteristics.

Regarding claim 33, Chen et al. teach in figure 3 and related text forming a third doped region 211 disposed between a first doped region and a second doped region. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a third doped region between said first doped region and said second doped region in Xu's device in order to improve the characteristics of the device.

Regarding claim 35, Chen et al. teach in figure 3 and related text an anode comprises

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a first doped region 206 and a second doped region 210 on a surface of a substrate, wherein said second doped region having a higher concentration of dopant than said first doped region.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use an anode in Xu's device having a first doped region abutting said cathode; and a second doped region on a surface of said substrate, wherein said second doped region having a higher concentration of dopant than said first doped region, in order to improve the characteristics of the device.

Regarding claims 37-38, Xu teaches in figures 7-10 and related text forming a plurality of diffusion regions 140 of said second conductivity type on a surface of said substrate, and forming a plurality of second isolation regions 132 that separate said plurality of diffusion regions from said cathode.

Claims 34 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu in view of Chen et al., as applied to claims 33 and 35 above, and further in view of Robinson et al. (5,268,316).

Xu in view of Chen et al. teach substantially the entire claimed structure, as applied to claims 26, 29, 33 and 35 above, except a third doped region comprises a retrograde-doped region. Robinson et al. teach a third doped region comprises a retrograde-doped region (column 3, lines 36-47). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to form a third doped region comprises a

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retrograde-doped region in Xu in view of Chen et al.'s device in order to provide low-reverse leakage, a relatively low voltage turn-on, and low series resistance for the current path from the junction to the diode contact.

Response to Arguments

Applicant's arguments with respect to claims 26-42 have been considered but are moot in view of the new ground(s) of rejection.

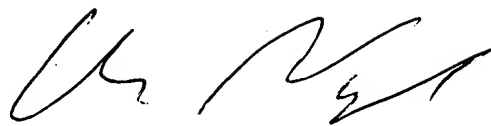
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ori Nadav whose telephone number is 571-272-1660. The examiner can normally be reached between the hours of 7 AM to 4 PM (Eastern Standard Time) Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Elms can be reached on 571-272-1869. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should

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you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'Ori Nadav', is positioned above the printed name.

O.N.
4/6/07

ORI NADAV
PRIMARY EXAMINER
TECHNOLOGY CENTER 2800